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ABSTRACT

This report presents six papers originally prepared for a policy panel meeting which explored the data ramifications of changes within postsecondary education brought about through the expanded use of technology. Following an executive summary and an introduction, the major papers are: (1) "The Growth of Technology-Based Educational Delivery and Its Implications for Data Systems and Policy Analysis (James R. Mingle); (2) "New Institutional and Programmatic Configurations (Dennis Jones et al.); (3) "Understanding New Faculty Roles and Work Patterns" (William F. Massy et al.); (4) "Measuring and Analyzing Student Participation Patterns" (Sally M. Johnstone et al); (5) "Assessing Student Progress and Learning Gains" (Peter T. Ewell et al.); and (6) "Analyzing Revenue and Expenditure Streams" (Frank Jewett et al.). A summary identifies questions and challenges suggested by the panel for the National Postsecondary Education Cooperative to address in the following areas: ramifications of technology for current surveys for both institutionally based and longitudinal studies; examination of the data ramifications of new relationships between learners and providers; the student as the unit of analysis; student assessment in a technology-based environment; new faculty roles and work patterns; and cost-effective analyses. (Contains 13 references.) (DB)

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Co-Sponsored by
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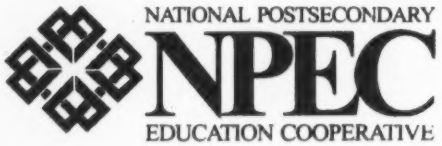
Washington, D.C.
August 4-5, 1997



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Report prepared for the National Postsecondary Education Cooperative (NPEC) Subcommittee on the Policy Panel on Technology by Panel contributors Thomas Campbell, George Connick, Michael Dolence, Peter Ewell, Patricia Freitag, Dennis Holmes, Frank Jewett, Sally Johnstone, Dennis Jones, Richard Markwood, William Massy, James Mingle, Edward Neal, Burks Oakley, Ronald Phipps, and Robin Zuniga. G. Phillip Cartwright synthesized their contributions and Robert Wallhaus provided introductory and summary sections. This work was carried out under the sponsorship of the National Center for Education Statistics (NCES), U.S. Department of Education.

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Contact
Nancy Schantz
(202) 219-1590

National Postsecondary Education Cooperative
Subcommittee on the Policy Panel on Technology and Panel Presenters

Subcommittee Members:

Virginia McMillan, *Chair*
Vice President
Illinois Community College Board

Cheryl Blanco
Director, Policy and Information
Western Interstate Commission for Higher Education (WICHE)

Melodie Christal
Director
SHEEO/NCES Communications Network
State Higher Education Executive Officers (SHEEO)

Carol Fuller
Assistant Vice President
Research and Policy Analysis
National Association of Independent Colleges and Universities

Robert Goertz
Director, Fiscal Policy
New Jersey Commission on Higher Education

Toni Larson
Executive Director
Independent Higher Education of Colorado

Dawn Geronimo Terkla
Executive Director
Institutional Research
Tufts University

Panel Presenters:

Tom Campbell
Vice President of Academic and Student Services
Illinois Central College

George Connick
President Emeritus
The Education Network of Maine

Michael Dolence
Michael G. Dolence and Associates

Peter Ewell
Senior Associate
NCHEMS

Patricia Freitag
Assistant Professor of Educational Research
Department of Educational Leadership
George Washington University

Dennis Holmes
Chair
Department of Educational Leadership
George Washington University

Frank Jewett
Director of Research Projects, IRT
Office of the Chancellor
California State University System

Sally Johnstone
Senior Program Director
Western Cooperative for Educational Telecommunications
Western Governors University

Dennis Jones
President
NCHEMS

Richard Markwood
Dean and Director
Central Oregon University Center

Bill Massy
President
The Jackson Hole Higher Education Group

James Mingle
Executive Director
SHEEO

Ed Neal
Director of Faculty Development
Center for Teaching and Learning
University of North Carolina at Chapel Hill

Burks Oakley
Associate Vice President for Academic Affairs
University of Illinois

Ronald Phipps
Senior Associate
Institute for Higher Education Policy

Robin Zuniga
Senior Research Associate
Western Interstate Commission for Higher Education (WICHE)

Consultant:

G. Phillip Cartwright

NPEC Staff:

Brenda Albright
Consultant to NPEC

Rosyln Korb
Program Director
Postsecondary and Library Cooperative Programs
NCES

Meredith Ludwig
Director
Postsecondary Statistics Support
ESSI/NCES

Nancy Schantz
NPEC Project Director
NCES

Robert Wallhaus
Consultant to NPEC

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Executive Summary

Widespread use of computer- and telecommunications-based technologies to deliver instruction and provide access to information resources has the potential to change significantly postsecondary education--its organizational relationships, financial operations, student participation patterns, and faculty roles and responsibilities. Technology will result in the removal of time constraints--instruction will be available when the learner wants it; and place constraints--instruction will be available at a virtually unlimited number of locations. Technology will open a wider range of student choices resulting in a transformation from an institutional-centered context for the delivery of instruction to a learner-centered emphasis. There will be greater competition and specialization across a wider range of educational providers, but at the same time a greater need for providers to cooperate and share resources.

These developments will have far-reaching ramifications for policy development in postsecondary education, and for the data that are needed to support policy analyses. New measures will need to be incorporated into postsecondary education data systems that reflect the changes being brought about through the expanded use of technology-based instructional delivery systems.

On August 4 and 5, 1997 the National Postsecondary Education Cooperative (NPEC) and The George Washington University co-sponsored a Policy Panel to explore the data ramifications of changes within postsecondary education brought about through the expanded use of technology. The Policy Panel convened individuals who provided insights and prepared papers concerning the impacts of technology on data definitions and analytical conventions in the following areas: (1) new institutional and programmatic configurations, (2) understanding new faculty roles and work patterns, (3) measuring and analyzing student participation patterns, (4) assessing student progress and learning gains, and (5) analyzing revenue and expenditure flows. These topics constitute the major sections of the report "Technology and Its Ramifications for Data Systems," which presents the issues explored by the Policy Panel. These issues are briefly outlined below.

New Institutional and Programmatic Configurations

Technology will bring about many changes in conventional approaches to the delivery of postsecondary education. While students have historically come to "learning sites," students will increasingly participate at locations remote from the campus and the instructor. Rather than being affiliated with a single institution, students will be associated concurrently with multiple providers and modes of instruction. Educational services will become "unbundled" with different providers carrying out various functions including curricular development, delivery of instructional modules, provision of student services, student evaluation and credentialing. Students will assume greater control over their educational experiences by designing programs that fit their specific needs with regard to program content, length, delivery mode and location--a significant departure from the tradition of institutions defining the terms of their relationships with students (e.g., the time and place of instruction, sequencing of courses, and placement

decisions). Program completion will be defined increasingly by the knowledge gained and skills mastered, rather than credit hours earned.

New Faculty Roles and Work Patterns

Faculty responsibilities and workloads will undoubtedly change as faculties become involved in technology-based delivery and instructional support systems. Less emphasis will be placed on lecturing and greater emphasis on facilitating the educational process. Efforts will be made to draw upon the capabilities of technology to increase student learning productivity by integrating technologies in ways that are tailored to the optimal learning modes of individual students, by capitalizing on the flexibility of technologies to make better use of student time, and by making faculty content and delivery specialists available to students independent of location. Faculty will be learning facilitators; intervening when needed, and selectively providing motivation and assistance to students. Faculty will find it easier and more compelling to collaborate: faculty will increasingly work with multiple providers and institutions, team with other faculty, and make specialized contributions in skill and knowledge areas as well as in instructional functions (e.g., courseware development). New definitions of faculty activities will be needed as well as new ways to measure faculty workload.

Analyzing Student Participation Patterns

Student participation patterns have become more complex as larger numbers of older, non-traditional students have pursued postsecondary education goals. Expanded use of technology will accelerate these trends, and the need to address related data and analytical issues would likely become more pressing. As technology results in multiple providers and modes of delivery, it will become more difficult to learn about student participation by seeking information from institutions. New ways will need to be found to link student data across providers, some of which may not be traditional institutions and learning modes. Asynchronous modes of learning made possible by computer-based systems and the Internet raise questions with regard to when learning begins and how long it lasts. Self-paced, asynchronous experiences also tend to undermine the utility of time-based proxies for student participation and outcomes (e.g., retention and graduation rates, enrollment census dates) and also have implications for credentialing and the portability of credentials. Furthermore, many administrative operations depend upon traditional student attendance measures, including assessment of student charges, unit cost analyses, administration of student financial aid, recording student progress, budget formulas, and determining eligibility for professional licenses. Pressing questions related to how traditional institutional-based data collection systems can be linked to student-based data collection systems, and how "old" data points can be mapped to "new" data points so valid trend analyses and comparative analyses can still be carried out, will need to be addressed.

Assessment of Student Progress and Learning Gains

A wider array of providers and a more market-oriented environment will place a higher premium on information about the quality of learning experiences in consumer choice, accountability and regulatory contexts. However, measuring student progress depends upon having insights regarding "progress toward what?" With technology, students will to an even greater extent determine learning goals--and will be the source of information about learning goals. Students will proceed toward learning goals at different paces and with different rhythms, rendering largely irrelevant traditional measures of "seat time" as the principal indicators of student progress. Competency-based measures will likely become increasingly important as the basis of academic accounting. Analysts have historically encountered challenges in studying the relationships between input, environmental and outcome variables; but the simultaneous delivery of multiple learning experiences, by multiple providers, using multiple delivery systems will add a new dimension of complexity to studies of the effects of inputs and environment on learning gains. Computer-based instructional delivery systems provide greatly enhanced opportunities to capture timely data about student behaviors, learning strategies, and patterns of achievement—but they also heighten concerns about confidentiality and privacy with respect to student data. Issues related to privacy and confidentiality will be exacerbated by the ease with which vast amounts of data can be captured and accessed via technology.

Analysis of Revenue and Expenditure Streams

While current accounting systems appear capable of accommodating revenues and expenditures related to technology-based systems, difficulties could be encountered in reconciling revenues and expenditures across the fund accounting procedures used in postsecondary education with the charts of accounts and accounting procedures used by non-collegiate providers of instruction and student services. In addition, procedures for allocating expenditures and revenues across multiple providers pose some troublesome questions: How are student tuition and fees collected from multiple sites that are supported by different providers and staffed by faculty from different institutions to be distributed? Similarly, what proportion of the costs of shared facilities, faculty and equipment will be paid by the various providers? How will revenues and expenditures for shared and unbundled operations be reported, and by whom? What are the ramifications for student financial aid allocations? New categories of costs (e.g., for courseware development, telecommunications equipment and services, faculty development, remodeling and rewiring facilities, electronic storage and transmittal of information) will likely need to be defined, and a shift in the relative importance of certain costs will undoubtedly occur, resulting in a need to make modifications in reporting categories and aggregations. Similarly, new student and faculty activities may require new classifications and definitions, or may require clarification as to how they are classified in current program structures (i.e., is responding to student questions via e-mail a support activity or a direct instructional activity?). Since new modes of delivery based upon technology will need to co-exist with traditional instructional delivery across postsecondary education, accounting and reporting systems will need to be designed to simultaneously accommodate multiple delivery systems.

Responding to these issues in a timely and meaningful way presents a significant challenge for the development of national data systems and improving their utility for policy analysis at all levels within postsecondary education. Potential steps that the NPEC could take to address the ramifications of wide spread adoption of computer and telecommunications-based technologies for national data systems are presented in the Summary of Challenges and Potential Next Steps.

Introduction: Technology and Its Ramifications for Data Systems

Consider a course being delivered concurrently to students "affiliated" with several different institutions who are simultaneously taking instruction at multiple interactive audio-video sites (some of which are owned by non-collegiate organizations). The course is being team-taught by several faculties, some of whom work for out-of-state institutions. Who owes tuition to whom, and who collects and reports it? Are students included in the fall enrollment count of the institution where they are registered or, are they allocated to the institutions whose faculty taught the course? What is the unit cost of instruction in this example? How do we define in-state and out-of-state migration? In summary, what new data constructs will be required to describe analytically this instructional delivery environment?

Or, consider a student acquiring new knowledge and skills via the Internet; tapping into learning modules and information resources created by faculty from several different institutions; and receiving directions and asking questions of faculty mentors on an as needed basis. Students with similar learning objectives work toward their goals independently, and achieve them over different periods of time. Who defines when the knowledge and skill acquisition process has been completed under these conditions? On what basis is credit awarded? How is faculty workload measured? What does full-time equivalent student mean?

As computer and telecommunications based technologies are increasingly used to deliver instruction, adaptations will need to be made in postsecondary education administrative, planning and policy development processes. These changes will bring about a need for new kinds of data--both to support underlying analytical efforts, and because new measures will be needed to describe this new environment.

These changes have been underway for some time as non-traditional students--older adults, place bound by job and family responsibilities--have sought educational opportunities at locations and over timeframes that are conducive to their needs, and institutions have responded in non-traditional ways--by expanding off-campus offerings and making courses available in evenings and over weekends. Technology, however, will both expand access to these opportunities and accelerate the pace at which they are sought and made available. The associated changes in academic and administrative operations will become more pressing, and so will their data ramifications.

Against this backdrop, the National Postsecondary Education Cooperative (NPEC) recognized that an effort to examine the data ramifications of technology was central to its mission of improving the utility of data systems for policy development, implementation and evaluation at all levels of postsecondary education. At its January 1997 meeting the NPEC Steering Committee appointed a Subcommittee to plan a Policy Panel to explore the data issues related to the widespread adoption of technology. The Subcommittee was chaired by Virginia McMillan, Vice President for Policy and Planning at the Illinois Community College Board.

The agenda that emerged from the efforts of the Subcommittee focused on six major questions: (1) As an overview, in what directions are technology developments in postsecondary education headed and what are their policy implications? (2) What kinds of new institutional and programmatic configurations are likely to emerge as a result of the adoption of technology? (3) What effects will technology have on faculty roles and work? (4) How will student participation patterns be analyzed? (5) How will student progress and learning gains be assessed? and (6) in what ways will technology change revenue and expenditure flows? To help shape this agenda, the Sub-Committee commissioned "lead presenters" to outline the key issues within each of these topical areas prior to the Policy Panel meeting, and to lead a discussion of their data ramifications at the Policy Panel meeting. Facilitators were also identified within each area to provide additional perspectives and insights. The lead presenters and facilitators are identified in Appendix A.

The Policy Panel meeting was co-sponsored with The George Washington University and held on August 4 and 5, 1997 on the university's campus. The deliberations of the Policy Panel reinforced the urgency of the challenges related to expanded use of technology in postsecondary education and the need for NPEC to collaborate with other organizations to address the data ramifications associated with the questions listed above that formed the Panel's agenda. Subsequent to the Panel meeting, the Lead Presenters, with the assistance of the Facilitators, developed papers which captured the key findings and conclusions of the Policy Panel discussions and offered recommendations regarding future steps that might be taken by NPEC and/or other organizations. These papers are summarized following the introduction. The full papers are available from the authors, whose addresses appear in Appendix A. The final section of the report summarizes the challenges and potential next steps. Appendix B lists the Policy Panel participants.

The Growth of Technology-Based Educational Delivery and its Implications for Data Systems and Policy Analysis

James R. Mingle

As the ubiquity of broadband digital networks grows and access to information technology tools continues to expand, we can expect a further acceleration of the already rapid growth of distance learning delivery in higher education. These technological developments also fit well with demographic and industry trends in higher education which are likely to accelerate the demand for "any time, any place" educational delivery. We can expect continuing calls for courses aimed at working adults, often in a work setting. We can also expect policymakers to support some technology-based instruction for traditional-age students because of expectations for productivity improvements in higher education and lower cost strategies to meet the enrollment demands created by increasing high school graduating classes. The likely impact of this push for technology-based instruction will be significant changes in organizational structures of higher education and new partnerships and consortia to deal with competitive market and cost issues.

The Growth of Technology-based Instruction

While higher education's use of information technology tools—such as networked computers, satellite transmission, and two-way video conferencing—has a substantial history, a number of developments are occurring to accelerate the pace of change. Distance learning operations through centers of continuing education or extensions have been especially affected. In fact, an activity once limited to a small number of schools has become relatively commonplace across the enterprise. Recent estimates put the number of traditional colleges and universities in the distance learning business at near 60 percent (CAUSE estimates). In its business plan, the Western Governors University, an emerging electronic university, estimated the total distance learning enrollments in traditional institutions at approximately 750,000 students with an additional 400,000 students enrolled in the programs of the adult learning service of PBS. In addition, WGU estimated that about 1.1 million corporate employees participate in distance learning courses each year.

With the extraordinary growth of the Internet (American Internet User Survey, 1997) and the World Wide Web, web-based clearinghouses for on-line courses have recently emerged and provide more evidence of the growing presence of asynchronous electronic curricula. The Global Network Academy, for example, boasts more than 10,000 course listings at this writing. Industry sources estimate that the web-based corporate training market is likely to be close to $2 billion by the year 2000. Executives at Jones Intercable and its university brokering service, Knowledge Online, believe the global training market may be as high as $160 billion annually.

According to Kenneth Green's latest *Campus Computing* survey (1996), nearly 80 percent of institutions currently have a presence on the Web and over half of all public four-year institutions have a strategic plan for the use of information technology in instruction and scholarship. Statewide technology plans reveal, however, significant disparities across campuses. Access to technology resources tends to be significantly higher in the four-year sector than on

two-year campuses, and higher in urban corridors than in rural areas (see Mingle, Epper, Ruppert, 1996).

Traditional Higher Education as a Mature Industry

Arthur Levine (*Chronicle of Higher Education*, January 31, 1997) explained much of the current environment of higher education by describing it as a "mature industry"—an enterprise subject to either decline or significant transformation. The most persuasive evidence of this maturity is the percentage of high school graduates who matriculate, now at about 65 percent of the cohort. As enthusiasm for increasing enrollments among traditional-age student's wanes, we can expect colleges and universities to look elsewhere for growth opportunities. Green (1997) notes that enrollment projections by the U.S. Department of Education put the 25-years and over population at over 45 percent of total enrollments by 1998. This continuing emphasis on adults will be moderated somewhat by what has come to be known as "Tidal Wave II," a 20 percent growth in the high school graduating class between 1996 and 2005 (Green, 1997). States facing this growth in traditional enrollments (such as Florida, Texas, California, Utah, and Nevada) are also showing marked enthusiasm for technology solutions in preference to campus building.

Impact of Technology on Organizational Structures in Higher Education

Advocates of "designated distance learning operations" such as Daniel (1996) and Schweiger (1995) believe that distance learning is distinctive enough that it is best handled by an organization whose sole purpose is this mode of delivery. Economies of scale also suggest that the "mega-universities" have distinct cost advantages as well. Green (1996) and Bates (1995) argue the opposite case—that the decentralizing power of the Internet puts the strength with the "small battalions." In their view, every faculty member is a potential global marketer of courseware.

A middle ground is proposed by Mingle and Epper (1997): new kinds of organizations that provide centralized services to decentralized content providers are emerging. Institutions such as Knowledge Online and Western Governors University will provide registration, bookstore, document delivery, and other services to member institutions that provide degrees. Western Governors University plans to serve as both degree-grantor for competency-based curriculum and a broker and aggregator for participating institutions. Many existing institutions, especially community colleges and local learning centers, are taking on the brokering function as they become "receive sites" for curriculum delivered by baccalaureate and graduate institutions.

For the National Center for Education Statistics (NCES), these new organizations present an interesting challenge: institutions that perform significant functions in the delivery of education but have no faculty, very few facilities, and a confusing set of "outputs." Increasing competition in the electronic environment may accelerate the level of cooperation in higher education, pushing some institutions toward consortial and partnering arrangements. The nature of technology also suggests the possibility of further desegregation of functions, for example, institutions that only credential; different institutions that aggregate and market; others that provide document delivery, counseling, and mentoring. We can also expect a much more

dynamic environment—new institutions emerging, others closing or significantly altering their functions or delivery modes.

Implications for Policy Analysis

The data collections of the U. S. Department of Education and of NCES reflect for the most part the scope and conduct of traditional colleges and universities. The central question that NPEC should address is how to adjust to the growth of technology-based delivery that is asynchronous and often non-site specific. It is recommended that NPEC and NCES undertake the following:

1. *A thorough review of institutional-based surveys to determine what definitions and data elements need to be modified to reflect technology developments.* For example, in the IPEDS institutional characteristics survey, institutions are asked about course locations and modes of instruction; neither question reflects the use of asynchronous Internet delivery. In the fall enrollment survey, the growing incidence of multiple institutional enrollments simultaneously in the same term calls into question the validity of aggregate enrollment totals. In the finance survey: How are institutions currently categorizing the costs of software, hardware, and licensing fees which are used directly in instruction—as "instruction" or "academic support"? How are costs being recorded for outsourced services? In many cases, new data categories can simply be added to a few existing data elements. In other places, new data elements may be needed.

2. *Possible expansion of the universe of institutions examined in current NCES surveys.* The growth and proliferation of education providers suggests a reexamination of the definition of postsecondary education used within IPEDS. How might an institution which serves as a receive site and support center for multiple content providers be classified? Should some institutions (for example, corporate training sites) which are not open to the general public be included? Another area of extraordinary growth for colleges and universities is continuing education (often defined as avocational but increasingly relevant to workplace skills). These courses reflect a substantial educational activity. The critical questions for NCES are how far the current universe of higher education providers can reasonably be expanded and how to classify the new types of providers.

3. *Incorporation of technology-related issues in current national surveys that use individuals and students as the unit of analysis.* These surveys provide an opportunity to assess a number of technology-related issues, which cannot be captured in institutional surveys. The National Household Education Survey or the National Postsecondary Student Aid Study, for example, could be used to determine the level of multi-institutional enrollment (and the location and nature of the providers), computer access and ownership, satisfaction with different modes of educational delivery, and educational progress.

4. *Development of quality benchmarks that are relevant to technology-based delivery.* This recommendation is most relevant to states and to the accrediting community with some technical assistance from NCES and NPEC. The current emphasis on "outcomes" as the quality benchmark in higher education may need to be reexamined. As more students enroll with

multiple providers and pursue units of instruction that are not time- or course-based (for example, competency assessments), the relevance and accuracy of our current definitions of retention and graduation rates will be called into question. While policymakers are concerned about input/output ratios, a "customer focus" on students and parents leads one to emphasize process measures which capture the quality of the environment. Relevant quality measures may be the speed, quality, and cost of electronic delivery, the quality of the software, and the technical reliability of the delivery mode. A number of applicable benchmarks come to mind that could be incorporated into existing NCES data collections: (1) measures that assess the quality/capacity of technology resources on campus (similar to those developed by Green); (2) measures that assess student access to technology and networks; (3) costs of user access to networks and data bases; and (4) levels and types of electronic interaction.

New Institutional and Programmatic Configurations

Dennis Jones
Contributors: Michael Dolence and Ron Phipps

Higher education, slowly but surely, has been moving toward a more client-centered focus. This shift has been given added impetus by the emergence of technology that allows students to access learning modules whenever, wherever, and from whomever they choose. This evolving reality has major implications for both the data needed for policy analyses and the procedures appropriate for the acquisition of these data.

Historically, higher education has been a provider-driven enterprise. The "industry" has been defined in terms of those organizations–colleges, universities, or trade schools–that have education as their primary mission. The size of the industry has been constrained by the requirement that, in order to receive federal funds, providing institutions be accredited through a process involving a review by their peers to assure an acceptable level of quality. Since the criteria for accreditation have focused primarily on resources/inputs and processes, the result has been a press toward a conventional approach to doing business within the industry.

This approach is characterized by:

- conditions in which students physically come to campuses or other learning sites to receive educational services face-to-face
- "bundled" services, in which a single entity provides both instructional courses and the associated student support services
- prices established in terms of the amount of instruction bought; student services included in the instruction price
- place and time of instruction, sequences of instruction, terms of admission, etc., dictated by the institution
- a presumption that a learner will be affiliated with only one provider at a time
- learning assessed and credentials awarded by the provider of instruction
- an assumption that the learner's objectives are those specified by the provider–completion of a degree or certificate, as well as the corollary assumption that learning is complete when the degree is attained
- treatment of lifelong learning as a revenue-generating auxiliary enterprise rather than as a legitimate and necessary component of the educational mainstream

This orientation to the provider has strongly influenced the administrative processes of higher education; for example, funds for both institutions and students are channeled through the

institutions and in almost all cases the administrative records of consequence either reside in, or are initiated by, colleges and universities. This circumstance has historically made collection of data about higher education relatively straightforward since institutions are the obvious source of data; the universe (of accredited institutions) is unambiguously specified and of a manageable size; and the data-building blocks of activities and functions have been generally similar across seemingly very different institutions. While standardization has taken considerable effort, it has not been necessary to create totally different data collection approaches for different kinds of institutions.

Over the past decade, many of these basic conditions have started to erode. The advent of more flexible and powerful technologies has served to amplify many of these changes. Central is the capacity of this technology to remove the constraints of place and time. In the evolutionary sequence, the first constraint removed was that of place. Through use of telecommunication technologies, the requirement that students be in the same physical location as the faculty member was removed; the student could participate in class activities at a location remote from the teacher. This step, however, still left the providers very much in the driver's seat. It has been the emergence of technology that removes the constraint of time that threatens to open the floodgates of change.

The technology empowers the consumer, allowing him/her to much more significantly affect the nature of the relationship between learner and provider. While the specific nature of this evolving relationship is not yet known, informed speculation suggests several key features:

- The diversity of learner objectives can find expression as learners shop for learning opportunities that fit their specific needs. Technology is making it easier for students to design their own learning programs, which may be quite different in purpose, structure, content, and length from those prepackaged by institutional providers.

- Students will concurrently enroll at multiple institutions. What looks like a part-time student to an institution may well be a full-time student creating "full-timeness" through part-time enrollment at multiple institutions. This has implications not only for data systems and approaches to reporting such basic facts as number of students, but for the mechanism for determining eligibility for student financial aid and other administrative functions.

- Market forces will lead to "unbundling" the educational services as they are normally provided by traditional colleges and universities. This unbundling will likely occur along multiple dimensions.

- Instructional and student services will be separated. Students learning at a distance can be expected to reject the notion of paying for services they don't use. It is a small step for them to purchase some of these services from providers other than those offering the instructional program.

- Courses will be dissembled into modules of learning that promote mastery of particular skills or acquisition of particular competencies. This opens the door to situations in which students can build learning programs out of modules rather than courses–and to situations in which

those modules might be acquired from different providers.

- Instruction will be separated into parts–curriculum planning, courseware development, delivery of information, mediation of student interaction with learning materials, assessment.

- Different organizations may specialize in these various functions.

There are numerous implications of the kinds of developments that are likely to arise as a consequence of the emerging technology. First, assumptions about the functions being performed by educational providers will have to be reexamined; more likely, information about services provided would have to be made explicit rather than assumed. The institutions will have to accommodate not only separation of instructional and student service functions but separation of activities within what has historically been considered the instruction function. Second, the array of legitimate providers will be expanded–beyond accredited institutions that are full-service providers to organizations that specialize in producing/distributing learning modules, providing student services and certifying learning and competence. The artificial definition of the universe of providing organizations will be harder to sustain. Third, data collection will have to reflect the reality that students deal with multiple providers simultaneously (and that there are mutually beneficial alliances among providers as well). Fourth, the definitions of program and program completion will have to change to reflect a broader array of learner objectives and certifications that reflect mastery of skills/acquisition of knowledge in combinations different from traditional degrees. Finally, information about methods of delivery will become more important, if for no other reason than to serve as an aid in understanding variations between institutions and to support critical policy analyses concerning costs and effectiveness of different approaches to delivering educational services.

Since so many of the basic conventions of data collection in higher education are grounded in assumptions about time, any significant movement toward true asynchronous delivery has particularly significant implications. Time-based measures undergird descriptions of the college calendar; define census dates for provision of data (e.g., opening fall enrollments); serve as the central element in defining the basic unit of educational activity, the Student Credit Hour; allow the distinctions between those who are ostensibly fully engaged in educational pursuits and those who aren't; provide a basis for determining appropriate academic progress (including retention and graduation rates); and allow point in time data (e.g., fall term census data) to serve as a proxy for activities that occur over a period of time.

The erosion of some of these key, time-based conventions poses a significant challenge to the established approaches to data collection. These established approaches are further challenged by the unbundling of educational functions and the increasing possibility (and probability) that substantial numbers of students will not have one-to-one relationships with educational institutions. These two factors, when considered in concert, suggest that it will be impossible to acquire the information needed for formulation of policy about higher education using institutions as the primary informant. Data systems, as well as educational practices, will have to become more learner-centered.

Understanding New Faculty Roles and Work Patterns

William F. Massy
Contributors: Edward Neal and Burks Oakley

Many observers of higher education believe that information technology will fundamentally transform professorial roles and work patterns (Massy, 1996). The possibility of such shifts raises serious questions about the adequacy of public and private data systems. Significant changes are needed in order to track the path of change and to project the new equilibrium. Being able to do so will be important for public policy and for institutional decision making, and it also should have a salutary effect on the adoption of productivity-improving innovations. If, on the other hand, the pace of change fails to meet expectations, the new data will help us understand why, and help us determine whether interventions are needed and appropriate.

Changing Approaches to Teaching and Learning

According to the prognosticators of change, most faculty will become teaching and learning process designers and managers as well as content specialists. Faculty will:

- spend less time "professing" and more time on educational process matters
- integrate appropriate technologies, external content, and support staff activities to maximize student learning productivity
- monitor student progress, intervene or refer to appropriate faculty specialists as appropriate
- in the classroom, provide stimulus and motivation, convey non-codifiable knowledge, and model what it means to be competent.

The faculty's role as content specialist will change as well. Achieving a global, national, or regional knowledge monopoly in an academic subspecialty will become less important than institution-specific knowledge about student needs and how to get things done in the local environment. Disciplines will have to rethink the relevance of traditionally taught materials and the efficacy of traditional teaching methods. New fields of study not necessarily rooted in the disciplines will emerge. The best content experts will leverage themselves by partnering with outside courseware-producing entities, although this will not necessarily benefit their institutions in a direct financial way. While many believe these changes to be inevitable, others are skeptical. Indeed, the Panel itself was split on the issue. William Massy and Burks Oakley believe that higher education's transformation will be significant. On the other hand, Ed Neal believes "that the widespread application of technology to teaching and learning will not evolve as fast—or in the direction—that many experts have predicted" (Neal, 1997).

Because the skeptics' views are important and widespread, it is worth putting them in perspective. Neal offers three reasons why technology's impact will not be as great as might be

supposed. First, the disciples of change typically underestimate the difficulties—especially the cultural difficulties—involved. Sometimes these difficulties prove to be insurmountable. Second, higher education faces its own particular cultural barriers: traditional colleges and universities are deeply conservative when it comes to their structure and operation. Third, analogies drawn from the business community may not be applicable because higher education lacks the profit motive and market forces needed to drive innovation.

We may safely assume that the Panel's three participant-observers have interpreted their experiences accurately. But the observations differ markedly. Why? Do the differences matter for NPEC's purposes? The next paragraphs present an explanation for the differing visions. Then I argue that new data are needed no matter who ultimately turns out to be right.

Higher education's adoption of information technology for teaching and learning is proceeding in three stages (Massy, 1996):

1. *Productivity aids for individuals* allow teachers and learners to do the kinds of things they now do—plus things yet to be invented—faster and more effectively. Examples include word processing, spreadsheets, graphing programs, and electronic mail.

2. *Enrichment add-ins* inject new materials into the teaching and learning mix without changing the basic mode of instruction. Examples include information acquisition on the Web, and the use of video, multimedia, and simulation to enhance classroom presentations and homework assignments.

3. *Stimulants and enablers of educational process reengineering*. Reengineering starts by mapping the current process and evaluating it in terms of quality and cost goals. Then the reengineering team designs a new process which optimizes the available technology to better serve the student. The result is a mix of the old and new, each contributing what it does best.

Stages 1 and 2 enhance educational quality but they don't change the basic instructional paradigm. Most faculty in most institutions envision such examples when they think about information technology. These two adoption stages do not add up to a learning revolution. But examples of third-stage adoption, characterized by real paradigm shifts, are beginning to emerge. The reengineering process is not necessarily easy, but the innovations are coming into view at an accelerating rate. Furthermore, they work. There now are documented cases where learning quality has been maintained or enhanced while unit costs have been contained or even reduced. Both outcomes represents an improvement in academic productivity (Massy, 1995).

A second reason why observers describe the adoption process differently is that there are different adopter populations. Recent work by Robert Zemsky at the University of Pennsylvania's Institute for Research in Higher Education (IRHE) and by Charles Goldman and his colleagues at Rand have identified new institutional segmentation taxonomies that are highly relevant for present purposes. Zemsky's basic segmentation structure is as follows:

- brand-name institutions whose selectivity gives them market power, cater mostly to traditional students, enjoy high graduation rates, and defend traditional academic values

- middle-of-the-road non-selective institutions that cater to a mix of traditional and non-traditional students, enjoy much less market power, and have fairly traditional academic values

- convenience/user-friendly non-selective institutions that cater mostly to non-traditional and part-time students and espouse values that often are more in line with the business "quality culture" than academe. This is an emergent segment with growing market power.

The brand name schools are the most visible, but their numbers are relatively small. Most colleges and universities fall into the middle segment, and these also serve the lion's share of the students.

Broadly speaking the penetration of stage-3 information technology is strongest in the convenience/user-friendly segment, where market forces tend to dominate, and weakest in the brand name segments where traditional academic values dominate. The user-friendly segment also leads in the use of short-term and part-time faculty, while the brand-name institutions generally are the most resistant to this trend. The use of such faculty is up in all segments, however. Though this phenomenon is not directly related to the rise of technology, it has important implications for data collection.

Traditional academic values collide with market forces in the middle segment. Market forces now are driving change in many institutions. Some, like Northwest Missouri State University and Washington State University, already are pressing forward with paradigm-shifting information technology applications. Along with the schools in the convenience/user-friendly segment, they will demonstrate that stage-3 technology utilization can deliver better educational value for money. This will tilt the competitive playing field and force other middle-segment institutions to adapt. The competition eventually will spread to the brand name segment, although a smallish number of prestigious schools (which Zemsky describes as producing "medallion" or "super-medallion" education) may be able to retain their traditional culture and approach to teaching and learning. Stage-3 technology innovations shift the educational paradigm from teaching-as-handicraft to a more systematic and capital intensive approach. For example, the shift will produce (Massy, 1996):

- economies of scale and scope

- new cost structures

- better exploitation of the organizational learning curve (faculty will be more likely to work together to improve teaching and learning processes)

- intensified competition, especially around service level and outcome issues

Implications for Data Systems

Currently, we have fairly good data about faculty numbers nationwide, some data about faculty at the institutional level, and hardly any data at the level of institution and discipline or educational program. We have extensive survey data about faculty perceptions and attitudes, including attitudes toward teaching and research, but virtually no detailed and systematic information about what faculty actually do and how they do it.

Teaching loads and contact hour statistics are sometimes viewed as good faculty workload surrogates. They reflect the most obvious aspect of the ratchet, but they fail to track shifts in faculty discretionary time—shifts which, though more subtle, probably are more important in the long run. Refereed publications and other traditional measures of research and scholarly output are no longer viable surrogates for the productivity of faculty discretionary time.

The advent of technology compounds these problems. Stage-3 adoption requires substantial faculty time commitments—much more than are required for course preparation, course development, and out-of class student contact in conventional settings. Furthermore, stage-3 innovations will not necessarily follow traditional course structures or even today's academic calendar, and they may not permit the discrete assignment of faculty effort to courses or contact hours. The new paradigms may well require entirely new definitions of faculty workload. Continued use of the conventional definitions may inhibit the innovation process.

There are three reasons to be concerned about these issues:

- Detailed time-series and cross-sectional data pertaining to faculty represent prerequisites for econometric analysis of the academic production function. Even the possibility of shifts in the academic production function—for example, due to technology or the operation of the academic ratchet—makes such studies more important.

- Institutions need benchmarks, all the more so as the traditional approaches to faculty utilization come under challenge. Knowing what other institutions are doing provides an impetus for analyzing one's own data with an eye to effecting change (Zemsky, 1993).

- Better data describing the academic production function may improve parental and student decisions about where to go to school. While the data may not be popularly accessible (though we should not discount the power of the Web in this context), intermediaries can be expected to pick up and package the data in user-friendly formats.

The desirable information falls into three broad categories.

- *Information about faculty:* institution-level information about faculty numbers and FTEs by academic discipline, educational program, and type of employment contract.
- *Information about teaching and learning modalities:* institution-level information about the numbers and types of courses taught by faculty, and about teaching and learning in other than conventional course settings. These data should be discipline and program specific.

- *Information about faculty activities:* what faculty does with their discretionary time and how institutions, schools, and departments assure and improve educational quality. This kind of information is hard to collect statistically, but progress can be achieved through surveys and case studies.

Measuring and Analyzing Student Participation Patterns

Sally M. Johnstone
Contributors: Thomas Campbell, Patricia Freitag

The increasing use of telecommunications technologies for distance learning is changing some patterns in student behaviors that have a direct impact on how institutions, states and the federal government can track students. This increased activity leads to several new ways in which students are able to have access to and use higher education resources. Three general trends are emerging:

- Students using distance learning, or site independent courses, do so in several ways. For example, a student may have a "home" campus at which she/he is enrolled but may take courses from other providers, with or without the knowledge of the home campus. With no explicit partnerships between the multiple providers, there are no reasonable ways to accurately count students.

- Another change in student behavior is the tendency for students to ignore an institution's definition of a program of study which usually results in a degree or certificate. Students' employers may be defining areas in which they need additional expertise or, as Tom Campbell pointed out, they may be defining their education goals completely on their own.

- A third shift in students' behavior relates to when in their life span they take college courses. The popular press reports that at least half of all students enrolled in college level work are older than what is considered the traditional age for college students. The trend for students to shift in and out of college study while employed is made even easier with the new electronic forms of course delivery, which allow students to sit in their offices and take classes at a point in their career when they need the knowledge offered by a particular course.

When most students choose these newer ways to work with colleges and universities, it is no longer simply a matter of using institutional records to track students. When a student is enrolled simultaneously at several institutions and may be seeking a degree from an entirely separate institution, there can be problems in tracking students for various purposes including financial aid. If students are defining their own learning goals, they may not even earn a traditional degree, but that does not make their higher education endeavors any less valid if the workplace recognizes their achievements. However, tracking and counting students in this configuration will not be simple using traditional means and indices.

New tracking strategies will probably not be successful either if they are developed as add-ons to the current methodologies. It becomes necessary to re-conceptualize the data that will be useful for decision making. The notion of just counting students from traditional educational institutions has been called into question; it may well be that the necessary data to inform national policy decisions needs to be more complex that it has been in the past.

An entirely new means of measuring postsecondary activity must develop, encompassing information from several sources. One suggested model defines the categories that may be necessary to measure students in the new environment of electronically mediated teaching and learning. This model identifies "types of providers," "functions and activities," and "characteristics of students:"

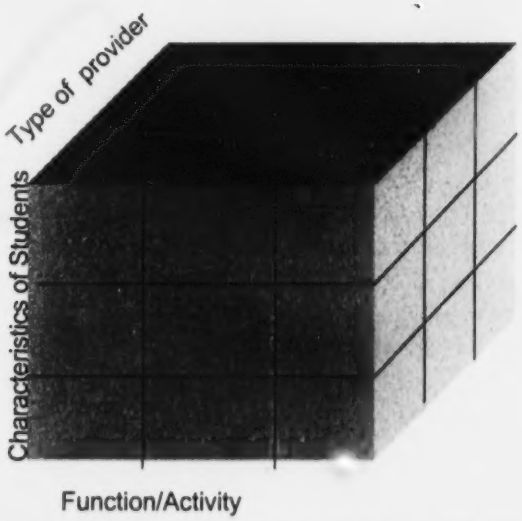

Figure 1. Model defining the categories that may be necessary to measure students in the new environment of electronically mediated teaching and learning.

The types of providers could include traditional colleges and universities, corporate universities, and/or other independent learning activities. The function/activity list might include such things as traditional classes offered either electronically or in a face-to-face setting, self-contained learning modules with no link to a teacher or tutor, and apprenticeship-type mentoring. The characteristics of students may relate not only to the usual demographic variables, but also to the learning credentialing goals which the student has.

This type of model poses some new problems for those collecting the information. It may require a shift in some of the data collection points. There is a rich tradition for gathering information from traditional higher education institutions, but what about the new education providers? What is the incentive to Novell Systems or Motorola University to provide detailed information about their activities?

Furthermore, as Patricia Freitag points out, the incentive for institutions to collect data on their students is high, but there may not be much of an incentive for students to provide the information needed. This is where creative statisticians may need to take a page from the marketing textbooks. It will require a new way of thinking to get students involved in providing the information needed.

The problem may turn out to be less challenging in light of the ways technology is being used to not only deliver learning materials to students, but also to collect their money, record their progress, register them for a professional license, etc. As Peter Ewell pointed out, each of these

electronic transactions leaves a record. The challenge then is to track those transactions as a data collection tool. One must first define the operational needs, then determine which points in the system can offer the most valuable information. It would be of value to start looking at databases that already do this, i.e. shared national data for financial aid.

Additional issues

- *How is "student-timeness" defined?* Students are considered "full-time" for many counting purposes if they are enrolled in a certain number of credit hours. For many years, the Carnegie unit was the standard unit used by most institutions of higher education to represent student achievement. Students earn Carnegie unit credit by participating in classroom instruction, completing outside assignments, and by passing tests and quizzes. With electronic delivery methods, less emphasis is given to the amount of time a student sits in a class with an instructor (seat time) and more emphasis is given to completion of other types of activities. Consequently, there is a need developing for a modification of the Carnegie unit or the development of a new unit as a measure of student progress. At the moment there is no widely accepted substitute for the Carnegie unit as a unit of measurement of progress. It is part of the vocabulary and is useful as an input indicator, but not relevant as an output variable. As Wayne Beacraft pointed out, the Carnegie unit was invented once and it may be time for a new concept. Perhaps this new concept needs to reflect the incremental knowledge gained by the students as opposed to the investment of faculty time.

- *What old measures must be kept to maintain continuity?* As Patricia Freitag pointed out, in order to make any comparative statements for policy decisions, we have to ensure that the old data points can somehow map to the new ones, or that some of the data in their current definition be retained to allow for comparative measurements and inform traditional and newly defined benchmarks.

- *What are the issues which arise in electronic tracking of students in the new environment?* Protection of the privacy for any individual's electronic transaction is critical, for example; and data mining techniques must work not only at the national level but must be coordinated to accommodate states' needs. As planning begins in this area, people from software development companies should be brought into the team.

- *How can these new data sets be used to make judgments about the quality of institutions?* As students set their own learning goals and have their progress toward these measured outside the institution offering the education, this traditional measure of institutional quality seems less interpretable. It may be that the value of an institution will begin to shift to the marketplace. If an institution continues to assist students in meeting their learning goals and provides high quality learning opportunities to students, the institution will be able to survive in the new electronic global higher education marketplace.

- *Does the shift to more student-centered higher education change what needs to be measured?* Some policymakers at the state level are starting to discuss the efficacy for public policy in funding state-supported higher education institutions when it is becoming possible to allow

students to shop for electronic coursework from anywhere. In Montana and Arizona, debates among legislators have led to the suggestion that students be funded directly. Under the proposed voucher plan, students could then choose how to spend their higher education dollars. While this suggestion has not yet been accepted, it is important to be aware that the discussions are spreading. If this idea becomes a reality in several states, federal financial aid may go the same direction. Then questions about tracking students will shift dramatically and the previously described method of using transactions to track activity may be the only alternative.

Assessing Student Progress And Learning Gains

Peter T. Ewell
Contributors: Dennis Holmes, Robin Zuniga

Assessments of "student progress" refer to measures that attempt to determine how students flow through the postsecondary educational process. The most prominent current examples of measures in this category are graduation and persistence-rate statistics, but growing in importance are inter-institutional transfer statistics and time-to-degree measures. Assessments of "learning gain," in contrast, refer to cognitive and other outcomes measures capable of detecting changes attributable to enrollment in postsecondary institutions.

Both of these areas have presented major measurement challenges for a long time, regardless of any impacts of technology. In the realm of student progress, the principal problem has always been the structure of existing databases: cross-sectional (term-oriented) enrollment records, archived and reported on an institutional basis, have always proven difficult to transform into the kinds of longitudinal student-postured files that are needed to track cohort progress–especially in a multi-institutional environment. In contrast, the main challenges in the realm of assessing learning gain have generally centered on instrumentation–and, more fundamentally, of gaining consensus about what ought to be assessed in the first place.

Discussions of student progress have historically been troubled by the question, "progress toward what?" Community colleges and other institutions enrolling large numbers of non-traditional students have rightly claimed that many of their students are not seeking degrees at all and should not therefore be included in the denominator. The primary goal of a given student in enrolling in Institution X, moreover, may be to earn a credential at Institution Y. Examining learning gain, in turn, tends to assume a system of education that is relatively self-contained and institution-driven. In contrast, more and more learning is taking place outside the confines of traditional institutions, and a good deal of it is open-ended–occurring across an entire lifetime.

Substantial lack of progress up to now in both areas means that there is not a lot of established measurement and reporting infrastructure now in place that will have to be dismantled. Paying attention to these areas from the fresh perspective of the changes wrought by technology thus offers an opportunity to engineer measures of student progress and learning gain into national data collection systems from the ground up.

Technology induces changes in the teaching-learning environment via three main forces:

- *Pressures due to dispersed modes of instructional delivery.* Absent common assessments of learning, the alignment of instruction with originally-established learning goals, as well as the maintenance of standards, become increasingly problematic as scale and distance increase. At the same time, distance-delivery modes introduce unknown impacts on learning, which will need to be assessed.

- *Pressures due to increasingly asynchronous modes of instructional delivery.* Students can proceed at different paces and rhythms in completing a course of study. Under such circumstances, continuous monitoring of students is required in order to determine their individual status and progress with respect to program requirements. This means that the data systems required to track students must be far more relational and "real-time" in nature than the time-based term-extracts typically used by institutional researchers to construct retention and completion statistics. Because of different frequencies and levels of engagement with instruction, moreover, performance on designated assignments or the actual demonstration of specific competencies become the only ways to "keep score" with respect to student progress.

- *Pressures due to increasingly multi-institutional modes of instructional delivery.* Easy access to instructional offerings from multiple providers accelerates an already-established trend of students attending more than one institution in the course of pursuing a given credential. Increasingly, this will require making the student the principal unit of analysis in constructing longitudinal databases, rather than trying to piece together myriad institutional records after the fact. At the same time, it will require the development of standard ways of recording and cumulating diverse instructional "episodes" regardless of where these occur.

All three of these pressures are forcing consideration of demonstrated competencies instead of time-based credit units as the principal basis of academic accounting. As shown by the burgeoning "skills certification" movement in business and industry, assessments can in practice be used to demonstrate and certify recognizable blocks of knowledge and skill that typically cover more than the content of an individual college course, but less than that covered by traditional postsecondary degrees. The results of competency-based individual credentialing of this kind, moreover, automatically generate data about program outcomes, potentially obviating the need for extensive, specially constructed data-collection systems on knowledge and skill acquisition.

At a deeper level, the application of technology has the potential to accelerate transformations in the actual teaching-learning process by allowing students to more actively engage stimulus material and to discuss reflectively with others what they have learned. But the use of technology by no means guarantees such outcomes. Absent appropriate faculty development and real attention to changed curricula and pedagogues, technology will merely magnify existing deficiencies. As a result, information about outcomes alone will not be sufficient to monitor and guide what is happening. Substantial data examining changes in core teaching and learning processes and in the construction of student educational experiences will also be required, and should not be confined to single courses, but instead examine how students develop and what they experience over an entire educational career and beyond.

Technology itself may be able to help meet some of these challenges. With regard to administrative databases, advances in sheer computing capacity have already allowed the construction of powerful longitudinal databases using state-level unit-record files drawn from both postsecondary institutions and other administrative agencies (e.g., the Unemployment Insurance wage record). These can help overcome what were once intractable problems of tracking student progress in an environment characterized by episodic, multi-institutional attendance. On the assessment side, technology-based testing–especially in its most powerful

computer-adaptive forms–can significantly shorten required testing times as well as providing quick informational turnaround and prompt feedback to individual test-takers. By its very nature, computer-based instruction also provides greatly enhanced opportunities to capture data about student behaviors, learning strategies, and patterns of achievement. Electronic media of this kind can also support more obtrusive forms of on-line classroom research, in which individual student reactions to and evaluations of what is being taught can be actively solicited and quickly compiled.

As always, the major obstacles to making progress in this realm are less technological than organizational. Issues about gaining the required consensus about what to measure (and what for) will likely continue to block the construction of any federal datasets about outcomes. As a result, progress in this area is likely to be driven by the emerging market for such information–driven by alternative educational providers and by growing requirements for competency-based credentialing on a field-by-field basis.

Recommendations for Action

- *The need for data about student goals.* Students participating in instruction via technology will be increasingly diverse with respect to the objectives that they are trying to accomplish. Several taxonomies of goals are already in use at community colleges that deal with diverse populations of this kind.

- *The need for "student-postured" as well as "institutionally-postured" data files.* Current data reporting on these domains is almost exclusively institutionally-based–that is, individual institutions report severally and separately on the students whom they happen to be serving at a particular point in time (e.g., fall term). Longitudinal studies must be specially constructed at considerable expense. Increasingly, however, unit-record information will be available to support analyses that track student experiences across institutions on a national basis (e.g., the National Student Loan Cooperative).

- *The need for "population-postured" (census-type) information as well as "student-postured" data.* Due to the episodic and unpredictable nature of instructional encounters, the most useful kinds of cross-sectional data snapshots will likely embrace entire populations. Levels of educational attainment or skills credentialing within a particular population (geographic or demographic) may be of more direct policy relevance for strategic planning than institutionally-supplied data on enrollment or degree awards.

- *The need for information designed to inform consumer choice.* Demands for accountability on the part of both clients and external bodies will continue to grow as instructional paradigms shift. But increasingly, the rhetoric of accountability is focused on the replacement of "reporting-based" regulatory accountability mechanisms with networks of "market-based" incentives designed to drive quality-improvement indirectly by shaping patterns of demand. For such markets to work, however, students will need sufficient information to make informed choices. At the same time, data about actual attainment levels are increasingly in

demand by employers, who constitute a "customer base" of a different kind. Information systems for the future will need to be designed to provide both.

- *The need to better link and share data across constituencies and data-collection agencies.* Many of the data needed to track students through complex patterns of work and educational experience are already being generated by various agencies, and can be effectively tapped to examine student progress. Examples include participation in the educational experiences provided by corporations and other institutions outside the established postsecondary universe and employment records maintained by state agencies or other authorities (e.g., the UI wage record). Some states are already beginning to link these together effectively.

- *The need to develop data-collection mechanisms explicitly designed to track changes in instructional process due to technology.* While probably the focus of periodic special studies rather than institutional census-type surveys, such information was seen as providing the only effective basis for determining the real kind and extent of changes that are actually occurring as a result of technology.

Analyzing Revenue and Expenditure Streams

Frank Jewett
Contributors: George Connick, Richard Markwood

To what extent can the current Integrated Postsecondary Education Data System (IPEDS) financial reporting structure accommodate and accurately portray asynchronous instructional delivery (lecture/lab with instructors at remote sites, instructional TV courses, etc.)? The current IPEDS revenue and expenditure categories were developed to describe the financial flows of traditional institutions of higher education. It is argued here that the "higher education" aspect of the current system is more important than the "traditional" aspect. As such the accounting categories, in general, should be adequate to describe the financial flows of many different forms of educational institutions.

Assumptions

The changes in postsecondary education related to technology are evolutionary, not revolutionary. The impact of electronic digital information technology upon postsecondary education and adult education has already begun and will continue into the foreseeable future. Three implications follow from this assumption:

- It is not too early to identify appropriate modifications in the data reporting systems to insure capture of data relating to the changes that are occurring.

- Since the demise of the existing institutions providing instruction in the traditional ways is not imminent, existing reporting formats should be maintained. This suggests that the best approach is to investigate how these systems should be modified to capture the necessary new data alongside the existing data.

- The description of the future postsecondary institution is a moving target. While there is a substantial amount of agreement that postsecondary education will be fundamentally changed by technology, it is much more difficult to discern how a typical institution will appear, say, 30 years from now.

Federal efforts to collect data on postsecondary and adult education should continue to focus upon formal educational activities, i.e., those where a student participates in an organized course of study provided by an identifiable second party. The data collection focus should remain upon instructional transactions between students and educational providers (in a manner analogous, for example, to customers and retail sales establishments) without regard to where the institutions obtain the instructional materials or how they obtain other types of support services.

Item Analysis of the Current IPEDS Reporting Categories

Revenue streams

(01) Tuition and fees: Out-of-state tuition for technology-mediated courses delivered to students residing out-of-state may be different from that for out-of-state students taught on-campus. Any tuition for remote (out-of-state) students in mediated courses that more than covers incremental delivery costs is a net gain to the institution. Technology fees are being assessed to recover some or all of the extra costs of providing mediated instruction. Such fees could be reported separately.

Because of the important role served by extension and continuing education in the use of mediated instruction, related fees could be reported separately. A closely related consideration is how to account for students at remote sites. As instruction migrates from campuses to various other sites, there is an incentive to enroll as many students as possible whether they have been admitted as regular university students or not. Although extension and summer session revenues and expenditures are included in IPEDS financial reports, summer session and extension enrollments and FTE may not be included. They should be.

(11) Sales and services of educational activities: This category would include revenues from the sale or licensing of mediated courses or course materials to other campuses or individuals.

The following items are not affected:

(02) Federal appropriations

(04) State government appropriations

(05) Local government appropriations

(09) Private gifts, grants, and contracts

(10) Endowment income

(12) Auxiliary enterprises (residence halls, food service, college unions, intercollegiate athletics, college stores, health services)

(13) Hospitals

(14) All other sources

(15) Independent operations

Expenditure Streams -- Primary Programs

(01) Instruction: In the traditional university environment the main form of expenditures is for faculty who are delivering live courses in classrooms. As various formats of mediated instruction expand and mature, the form of the expenditures may change substantially. Faculty may become part of instructional materials production teams, or may specialize entirely in advising students or in evaluating students. More types of faculty classifications may be recognized. Although functionally separate, the costs of mediated instruction may become practically inseparable from related expenditures under item 04, Academic Support, below.

Given the potential to create technology-mediated instructional modules that can later be reused, sold, or licensed to other parties: How to account for costs of instructional materials (e.g., courseware) purchased from an outside vendor or another campus? How to account for and reimburse faculty for their participation in the creation of instructional materials that are later sold or licensed to other institutions or individuals?

The following items are not affected:

(02) Research

(03) Public Service

Expenditure Streams -- Support Programs

(04) Academic Support: This is the other category in which current expenditures for the technical production, training and communications costs of mediated instruction would appear.

(05) Libraries: The impact of technology is to shift funds from the purchase of print media to licensing agreements for access to machine readable card files, bibliographies, databases and publications. Such a shift in holdings improves library access for students at remote sites.

(06) Student Services (includes admissions and records, social and cultural development, career guidance, and counseling): The admissions and records functions have been evolving independently toward dealing with all students remotely, e.g., on-line applications, computer/telephone assisted registration. As such, accommodating a growing proportion of remote students should not present any special problems.

An increasing proportion of remote students will probably raise some issues for the remaining student services functions. Some of these functions (career guidance, job placement, and some clubs and social activities) can easily migrate to the World Wide Web and enhance access for remote students. Where face-to-face meetings are still necessary (e.g., counseling) either students will come to campus or counselors will have to be made available at remote sites.

(07) Institutional Support: Some communications expenses associated with mediated instruction may appear here.

(08) Operation and Maintenance of Plant: With technology-mediated instruction, some of the expenditures for operation of campus grounds and facilities may occur at off-campus sites, including: permanent instructional facilities owned by the university, leased or rented facilities that may be used for several years, and short-term facilities rented or obtained through loan.

Expenditure Streams -- Capital Outlay

(02) Equipment Purchase -- current funds: Equipment replacement should be provided for as a current expense.

(03) Equipment Purchase -- plant, capital outlay or bond funds: Equipment used for delivery of technology-mediated courses should be treated as a capital expense. Much of this equipment has a substantially shorter useful life than buildings (e.g., 3-10 years). This raises some difficult issues of cost recovery. Even if cost recovery could actually be charged against mediated instruction, there is no place to accumulate the replacement funds in the public institution's accounting structure. Leasing may provide an option to avoid both the initial purchase price and the difficulty of cost recovery.

(04) Construction Expenditures -- plant, capital outlay or bond funds: This category covers expenditures for the modification of existing facilities and the acquisition of new facilities for delivery of technology-mediated instruction, including buildings, rooms, equipment, and networks (both on and off-campus).

The costs incurred to produce courses for delivery over more than one term are essentially capital costs although they are not currently accounted for as such. The expenditures undertaken for maintenance of these courses should be counted as a current expense.

(05) Land: Not affected

Key Conclusions and Recommendations

1. There do not appear to be major revenue or expenditure items related to mediated instruction or distance education missing from the current IPEDS financial reporting categories. The existing categories allow for capture of all financial data, with two exceptions:

(i) The depreciation charges of short-lived mediated instruction equipment are not reported, but this is the result of failure to capture any depreciation data in government accounting, not a consequence of the use of technology.

(ii) Costs incurred to produce course materials that will be used over a period of years are now shown under current expenditures but should be classed as capital expenses.

Another potential gap in reporting relates to how extension enrollments (or FTE) are treated. In some institutions, for example, extension revenues and expenditures are currently reported in IPEDS financial data but extension enrollments are not.

2. Reporting in the current financial categories results in a commingling of mediated instruction and distance learning activities with all the other regular instructional activities of the institution.

3. A study should be made, within the context of the emerging instructional technologies, of how best to align or integrate data from IPEDS and the National Household Education Survey (NHES). Both surveys deal with common subsets of data and each can be used to gain additional insights about the other.

Summary of Challenges and Potential Next Steps

The Policy Panel on Technology explored a wide range of issues related to the ramifications of computer and telecommunications-based technologies for postsecondary education data systems. The panel did not focus on specific projects that NPEC might pursue--that was not its purpose. But participants did suggest a number of challenges that provide a basis for determining what NPEC could do in the context of its mission to improve the utility of national data bases for policy development, implementation and evaluation. Some of these challenges will need to be addressed in the immediate future; others will require longer range efforts to reconceptualize approaches to postsecondary education data systems development. Challenges were suggested that involve a reexamination of current surveys; others would necessitate moving into uncharted waters. The following is a compilation of those questions and challenges suggested by the Policy Panel on Technology that could be the basis for future NPEC activities.

Ramifications of Technology for Current Surveys

Participants in the NPEC Policy Panel on the data ramifications of technology suggested that current surveys, both institutional-based and longitudinal studies, should be examined to determine what modifications might be needed to capture changes in student participation patterns and institutional operations resulting from the adoption of technology. A first step in this effort would be to develop a definition(s) of what constitutes "technology" as well as to expand current definitions of students, faculty and institutions to encompass broader concepts of learners, delivery mechanisms, and sponsors/providers. Based upon these broader concepts and definitions, an effort should be made to answer the fundamental question of "how much learning activity is occurring in different technology-based modes?" Answering this question will require the application of the definition of "technology" and the broader concept of "delivery mechanisms," coupled with a new metric(s) for measuring "participation." In addition, a thorough review of institutional-based surveys, such as IPEDS, as well as longitudinal studies, should be undertaken to determine what definitions and data elements need to be modified to reflect technology developments, and how surveys such as IPEDS and the National Household Education Survey (NHES) could be better aligned. There may also be opportunities to build upon longitudinal surveys of students and individuals to capture data that will be increasingly difficult to collect through institutional-based surveys as technology moves the context for planning and policy development from a provider-centered model to a learner-centered model.

Examination of the Data Ramifications of New Relationships Between Learners and Providers

New relationships between the learner and provider of educational services resulting from the adoption of technology are likely to occur in the following areas:

(1) Institutions are no longer the obvious source of data about postsecondary education;

(2) New sponsors of learning experiences will emerge as a result of the deployment of technology, and decisions will have to be made as to which will be encompassed by future NCES surveys and how this will be operationally accomplished;

(3) Basic data building blocks such as student activities and instructional functions will become less well structured and more diverse across providers;

(4) Students will be simultaneously affiliated with multiple providers;

(5) Definitions of program completion will reflect a broader array of learner objectives and certifications;

(6) Technology could undermine the relevance of many quality indicators that are currently used in postsecondary education (such as retention and graduation rates, student/faculty ratios, number of books in the library) as well as lead to a greater emphasis on measures which capture the "quality of the environment" (such as quality of software, graphics and transmission; student access to technology; and technical reliability of networks); and

(7) Asynchronous delivery of instruction will call into question time-based measures (e.g., opening fall enrollments, student credit hours, full-time vs. part-time, FTE, retention and graduation rates).

The ramifications of these new relationships between learners and providers for current data systems will need to be analyzed and new definitions will need to be developed.

Using the Student As the Unit of Analysis

Expanded use of technology seems to point to an increased need to focus on students as both the source of data and the development of new analytical conventions. Many questions need to be addressed in this regard:

(1) How a student is defined;

(2) How the completion of learning experiences are determined;

(3) Examining the utility of time-dependent student measures in an asynchronous environment;

(4) Determining what changes may need to be made to administrative procedures and policy analyses that are dependent upon student data;

(5) How to link student data across multiple providers, learning modes and agencies that collect student-related data;

(6) Protecting the integrity of historical longitudinal student data sets; and

(7) Addressing ever more compelling confidentiality and privacy issues.

Any of these issues could be the object of a separate NPEC activity.

Student Assessment in a Technology-Based Environment

Delivery of instruction in a technological environment characterized by multiple providers and multiple modes of learning, and delivered in student-paced time patterns, offers challenges for assessing student progress and learning gains in such areas as:

(1) Greater importance of obtaining information about student goals;

(2) Difficulty of determining a priori "who is a student" presents sampling difficulties, perhaps necessitating "population samples;"

(3) Overlays of inputs, environmental variables and outcomes associated with multiple, simultaneous learning experiences adds complexities to student behavior research;

(4) Use of computer-based systems to capture and analyze data on-line presents new design issues (e.g., ensuring compatibility across instructional management systems) as well as confidentiality and privacy concerns; and

(5) New data requirements resulting from technology in such areas as accountability, consumer decisions, accreditation, credentialing, and regulation of technology-based instruction.

Again, the question of how these issues could be packaged as NPEC projects would need to be determined.

New Faculty Roles and Work Patterns

As faculty become more involved in technology-based instructional delivery, their responsibilities, activities and workloads will change, necessitating a reexamination of data definitions and analytical conventions. For example, the following changes brought about by the widespread adoption of technology will have far-reaching ramifications for faculty roles and work patterns:

(1) Unbundling of the instructional functions of curricular development, instructional delivery, student counseling and support, and student evaluation could result in greater faculty specialization.

(2) Asynchronous, self-paced modes of instructional delivery will decrease the emphasis on "professing" and increase the emphasis on facilitating.

(3) As institutional boundaries that currently define where faculty carry out their activities become blurred, the terms and conditions of faculty work will need to be redefined.

(4) Changes in faculty activities associated with the adoption of new technologies will affect institutional staffing patterns, faculty reward systems, and the allocation of resources to support faculty development in significant ways.

(5) The adoption of computer- and telecommunications-based technologies will cause faculty to change how and where they carry out their work, resulting in a need to realign office, classroom and lab space.

These changes in faculty roles, responsibilities and work patterns that result from the wide-scale adoption of new technologies will have far-reaching ramifications for how faculty data are defined and used in both operational and policy contexts.

Cost-Effectiveness Analyses

Analyses of the unit (per student or credit hour) cost of instruction have historically been important in budget and policy development in postsecondary education. Cost analyses involve carrying out faculty activity analyses and then allocating the cost of faculty instructional activities to instructional programs or disciplines along with other instruction-related costs. Calculation of unit costs involves dividing by some measure of student effort such as student credit hours. An examination of the ramifications of technology on costing procedures would involve addressing the following important questions:

(1) Can student credit hour and FTE measures continue to be used; or would they need to be redefined or replaced by other measures?
(2) What modifications or additions to traditional categories of faculty activities would need to be developed?

(3) Will the classifications of programs need to be restructured, supplemented or redefined?

(4) What are the ramifications of different types of expenditures for cost allocation procedures and aggregations of costs?

It remains to be seen what role NPEC will see for itself in addressing these many questions and challenges. Clearly, there is more to be done than will be possible within the limited resources available to NPEC. Priorities will need to be set. And resources and responsibilities will need to be shared with other organizations that have an interest and capability to address certain of the challenges defined by the Policy Panel on Technology. For example, many of the questions raised are also relevant at the elementary and secondary education levels, and to a lesser extent to libraries. Any future NPEC projects related to the data ramifications of technology should look for opportunities to collaborate with the K-12 and library cooperatives, NCES, and other organizations with a mission to improve the policy utility of postsecondary data.

Bibliography

Bates, A.W. (Tony). *Technology, Open Learning and Distance Education*. London and New York: Rutledge, 1995.

Daniel, John. *Mega-Universities and Knowledge Media: Technology Strategies for Higher Education*. London: Krogen Page, 1996.

Green, Kenneth C., ed. "Drawn to the Light, Burned by the Flame? Money, Technology, and Distance Learning." *Education at a Distance*, Volume 11, No. 5 (May 1997), J-1 to J-8.

Levine, Arthur. "Higher Education's New Status as a Mature Industry," *Chronicle of Higher Education*, January 31, 1997.

Massy, William F. "Life on the Wired Campus: How Information Technology Will Shape Institutional Futures," in Diana Oblinger and Sean C. Rush (eds.), *The Learning Revolution*. Boston, MA: Anchor Publishing Co., 1996.

Massy, William F., and Robert Zemsky. "Using Information Technology to Enhance Academic Productivity." Washington, DC: Educom, Occasional Paper, 1995.

Miller, Thomas, director. "1997 American Internet User Survey," Emerging Technologies Research Group, FIND/SVP's, New York, New York. See http://www.findsvp.com.

Mingle, James R. and Rhonda Martin Epper. "Technology, Competition, and Organizational Structures in Higher Education," in Terrance MacTaggart, ed., *Excellence Through Independence*. San Francisco: Jossey-Bass Publishers, forthcoming.

Mingle, James R., Rhonda Martin Epper, and Sandra S. Ruppert. *Access to Information Technology: A Statewide Vision for Colorado*. Denver, Colorado: Colorado Commission on Higher Education, June 1996.

Monitor Company Memo to WGU Board of Directors. "Business Plan for the Western Governors University," April 14, 1997.

Neal, Ed. "NPEC Policy Panel on Technology and Its Data Systems Ramifications: Understanding New Faculty Roles and Work Patterns (Response to William F. Massy's Presentation)." Unpublished paper prepared for the NPEC project, August 1997.

Schweiger, Helmut. *Open and Distance Learning*. St. Paul: Minnesota Higher Education Coordinating Board, 1995.

Zemsky, Robert, William F. Massy, and Penny Oedel. "On Reversing the Ratchet." *Change*, 25:3, May/June, 1993, pp. 56-63.

Appendix

National Postsecondary Education Cooperative

Policy Panel on Technology

Panel Leaders, Facilitators, and Consultant List

August 4-5, 1997
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Panel Leaders

Dr. Peter Ewell
Senior Associate, NCHEMS
P.O. Drawer P
Boulder, CO 80301-9752
303-497-0371 (V)
303-497-0338 (F)
ewellp@spot.colorado.edu

Dr. Frank Jewett
Director of Research Projects, IRT
California State University System
P.O. Box 3842
Seal Beach, CA 90740-7842
562-985-9156 (V)
562-985-9642 (F)
frank_jewett@calstate.edu

Dr. Sally Johnstone
Senior Program Director
Western Cooperative for Educational Telecommunications
Western Governors University
P.O Box 9752
Boulder, CO 80301-9752
303-541-0232 (V)
303-541-0291 (F)
sallyjohnstone@wiche.edu

Mr. Dennis Jones
President, NCHEMS
P.O. Drawer P
Boulder, CO 80301-9752
303-497-0315 (V)
303-497-0338 (F)

Dr. Bill Massy
President, The Jackson Hole Higher Education Group
P.O. Box 9849
Jackson, WY 83002
415-723-1723 (V)
415-723-7578 (F)

Dr. James R. Mingle
Executive Director, SHEEO
707 17th Street, Suite 2700
Denver, CO 80202-3427
303-299-3685 (V)
303-296-8332 (F)
jmingle@ecs.org

Facilitators

Dr. Tom Campbell
Vice President of Academic and Student Services
Illinois Central College
One College Drive
E. Peoria, IL 61635
309-694-5011 (V)
309-694-5457 (F)
tcampbell@icc.cc.il.us

Dr. George P. Connick
President Emeritus, The Education Network of Maine
38 Florida Avenue
Portland, ME 04103
207-797-4768 (V)

Mr. Michael G. Dolence
Michael G. Dolence and Associates
P.O. Box 922
848 Decatur Circle
Claremont, CA 91711
909-625-9637 (V)
909-625-7327 (F)
mgdolence@earthlink.net

Dr. Patricia Freitag
Assistant Professor of Educational Research
Department of Educational Leadership
George Washington University
2134 G Street, NW
Washington, DC 20052
202-994-3567 (V)
202-994-5870 (F)
pfreitag@gwis2.circ.gwu.edu

Dr. Dennis Holmes
Chair, Department of Educational Leadership
George Washington University
2134 G Street, N.W.
Washington, DC 20052
202-994-7194 (V)
202-994-5870 (F)
holmes@gwis2.circ.gwu.edu

Dr. Richard Markwood
Dean and Director
Central Oregon University Center
2600 NW College Way
Bend, OR 97701
541-383-7252 (V)
541-383-7501 (F)
markwood@cocc.edu

Dr. Ed Neal
Director, Center for Teaching and Learning
University of North Carolina at Chapel Hill
Campus Box 3470
316 Wilson Library
Chapel Hill, NC 27599-3470
919-966-1289 (V)
919-962-5236 (F)
ed_neal@unc.edu

Dr. Burks Oakley
Associate Vice President
University of Illinois
506 S. Wright Street
Urbana, IL 61801
217-244-6465 (V)
217-244-4770 (F)
oakley@uillinois.edu

Dr. Ronald Phipps
Senior Associate
Institute for Higher Education Policy
122 Lee Drive
Annapolis, MD 21403
410-267-7593 (V)
ronphipps@aol.com

Ms. Robin Zuniga
Senior Research Associate
Western Interstate Commission on Higher Education
P.O. Drawer P
Boulder, CO 80301-9752
Fedex address:
1540 30th Street
Boulder, CO 80303
303-541-0223 (V)
303-541-0291 (F)
robinzuniga@wiche.edu

Consultant

Dr. G. Phillip Cartwright
1703 Woodway Road
Kent, OH 44240-5917
330-678-8585 (V)
330-672-4101 (F)
pcartwright@kent.edu

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Washington, DC 20208–5652

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